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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,039	01/29/2004	Toshiharu Furukawa	ROC920030272US1	4826
30206	7590	08/23/2005	EXAMINER	
IBM CORPORATION ROCHESTER IP LAW DEPT. 917 3605 HIGHWAY 52 NORTH ROCHESTER, MN 55901-7829			CAO, PHAT X	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 08/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/767,039	FURUKAWA ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Phat X. Cao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 July 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 and 42-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 42-45 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 7/11/05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

1. The cancellation of claims 16-41 in Paper filed 7/13/05 is acknowledged.

#### ***Claim Rejections - 35 USC § 112***

2. New claims 43 and 45 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In new claim 43, lines 5-6 and new claim 45, lines 4-5, a limitation "said insulating material **surrounding** said semiconductor nanotube within said passage" is not supported by the original disclosure. For example, Applicant's Fig. 10B shows an insulating material 40 disposed on a side of a semiconductor nanotube 43, but not disposed surrounding the semiconductor nanotube 43 within the passage as claimed.

#### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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4. Claims 1, 5-8, 12-15 and 42-45 are rejected under 35 U.S.C. 102(e) as being anticipated by Roesner et al (US. 2003/0132461).

Regarding claims 1, 5 and 42, Roesner (Figs. 1B-1C) discloses a vertical semiconductor device structure, comprising: a substrate 101 defining a substantially horizontal plane; a gate electrode 104 (center 104) projecting vertically from the substrate 101 and including a vertical sidewall; a spacer 104 (left 104) flanking the vertical sidewall; a semiconducting nanotube 108 of carbon atoms (par. [0070]) positioned between the vertical sidewall and the spacer 104 (left 104) and extending between opposite first and second ends with a substantially vertical orientation; a gate dielectric 109 disposed on the vertical sidewall between the nanotube 108 and the gate electrode 104 (center 104); a source 102 electrically coupled with the first end of the nanotube 108; and a drain 110 electrically coupled with the second end of the nanotube 108.

Regarding claims 6-8, Roesner's Fig. 1C further discloses that the spacer 104 (left 104) is separated from the vertical sidewall by a passage 106 (not labeled in Fig. 1C, see Fig. 1B), the passage 106 has horizontal dimensions appropriate for the growth of the semiconducting nanotube 108 and a vertical dimension greater than or equal to a vertical height of the vertical sidewall of the gate electrode 104 (center 104), and the passage has a rectangular cross-sectional profile when viewed in a vertical direction.

Regarding claims 12-15, Roesner's Fig. 1C further discloses a plurality of semiconducting nanotubes positioned horizontally between the gate electrode and the spacer, each of the plurality of nanotubes extending vertically in the

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passage 106 between opposite first and second ends, wherein space within the passage 106 not occupied by the plurality of semiconducting nanotubes 108 is filled by an insulating material 109.

Regarding claims 43-45, Roesner's Fig. 1C also discloses that the spacer 104 (left 104) is separated from the substrate 101 by a gap and the spacer 104 is separated from the sidewall by a passage 106 communicating with the gap, the semiconducting nanotube 108 being positioned in the passage 106, and further comprising: an insulating material 109/103 filling the gap and the passage, the insulating material 109/103 surrounding the semiconducting nanotube 108 within the passage 106.

5. Claims 1, 5-8, 12-15 and 42-45 are rejected under 35 U.S.C. 102(e) as being anticipated by Dubin et al (US. 2005/0167755).

Regarding claims 1, 5 and 42, Dubin (Figs. 5A-5F) discloses a vertical semiconductor device structure, comprising: a substrate 210/212 defining a substantially horizontal plane; a gate electrode 202 projecting vertically from the substrate and including a vertical sidewall; a spacer 215 (left 215) flanking the vertical sidewall; a semiconducting nanotube 250 of carbon atoms (par. [0045]) positioned between the vertical sidewall and the spacer 215 and extending between opposite first and second ends with a substantially vertical orientation; a gate dielectric 215 (right 215) disposed on the vertical sidewall between the nanotube 250 and the gate electrode 202; a source/drain 222/240 electrically coupled with the first end of the nanotube 250; and a source/drain 224 electrically coupled with the second end of the nanotube 250.

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Regarding claims 6-8, Dubin further discloses that the spacer 215 (left 215) is separated from the vertical sidewall by a passage (Fig. 5C), the passage has horizontal dimensions appropriate for the growth of the nanotube 250 and vertical dimension greater than or equal to a vertical height of the vertical sidewall of the gate electrode 202, and the passage has a rectangular cross-sectional profile when viewed in a vertical direction (also see Fig. 5C).

Regarding claims 12-15, Dubin (Fig. 5E) further discloses a plurality of nanotubes 250 positioned horizontally between the gate electrode and the spacer, each of the nanotubes extending vertically in the passage between opposite first and second ends, and wherein space within the passage not occupied by the nanotubes is filled by an insulating material 215.

Regarding claims 43-45, Dubin (Fig. 5E) also discloses that the spacer 215 is separated from the substrate by a gap and the spacer 215 is separated from the sidewall by a passage communicating with the gap, the nanotube 250 being positioned in the passage, and further comprising: an insulating material 215/214 filling the gap and the passage, the insulating material 215/214 surrounding the nanotube 250 within the passage.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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7. Claims 2-4 and 9-11 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Roesner et al (US. 2003/0132461).

Regarding claims 2-3 and 9, Roesner's Fig. 1C further discloses that the source 102 is composed of a catalyst material of cobalt or iron (par. [0056]) effective for synthesizing the nanotube 108 and positioned on the substrate 101 in vertical alignment with the passage 106, and the drain 110 comprises a catalyst material of cobalt or nickel (par. [0076]) effective for synthesizing the nanotube 108.

As to the grounds of rejection under section 103(a), the method of depositing the conductive layers selected from chemical vapor deposition, is an intermediate process step that does not affect the structure of the final device. Therefore, the process limitations (formed by a chemical vapor deposition) recited in a "product by process" claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 4 and 10-11, Roesner's Fig. 1C also discloses that the spacer 104 (left 104) is vertically spaced relative to the substrate 101 to define a gap, and the gap is filled by an insulating material 103.

As to the grounds of rejection under section 103(a), the method of depositing the conductive layers selected from chemical vapor deposition or the gap being filled by an insulating material after..., is an intermediate process step that does not affect the structure of the final device. Therefore, the process

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limitations recited in a “product by process” claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

8. Claims 2-4 and 9-11 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Dubin et al (US. 2005/0167755).

Regarding claims 2-3 and 9, Dubin (Fig. 5C) further discloses that the source/drain 222/240 is composed of a catalyst material (par. [0059]) effective for synthesizing the nanotube 250 and positioned on the substrate in vertical alignment with the passage.

As to the grounds of rejection under section 103(a), the method of depositing the conductive layers selected from chemical vapor deposition, is an intermediate process step that does not affect the structure of the final device. Therefore, the process limitations (formed by a chemical vapor deposition) recited in a “product by process” claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 4 and 10-11, Dubin (Fig. 5C) further discloses that the spacer 215 (left 215) is vertically spaced relative to the substrate to define a gap, and the gap is filled by an insulating material 214.

As to the grounds of rejection under section 103(a), the method of depositing the conductive layers selected from chemical vapor deposition or the gap being filled by an insulating material after..., is an intermediate process step



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that does not affect the structure of the final device. Therefore, the process limitations recited in a "product by process" claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PC  
August 19, 2005

  
PHAT X. CAO  
PRIMARY EXAMINER